SOUTH QUALITY

PROFICIENCY TESTING PROVIDER

REPORT No 12097

***Date of issue**: October 14, 2026*

Status: FINAL REPORT

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ASTM E1085

ANALYSIS OF LOW-ALLOY STEELS BY WAVELENGTH DISPERSIVE X-RAY FLUORESCENCE SPECTROMETRY

Program: SQ-0029

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1. FOREWORD

This report summarizes the results of the **SQ-0029** proficiency testing program on the determination of the composition of low-alloy steels by wavelength-dispersive x-ray fluorescence analysis. This program is conducted in a bilateral format, following the "split-sample" design described in clause A.4.2 of ISO/IEC 17043: 2023 (Alternative interlaboratory comparisons).

South Quality conducted the testing program in August/September 2026 with the aim of assessing the laboratory's ability to competently perform the designated tests.

2. ORGANIZATION

Program Coordinator:	Eng. Alfredo Schmidt
Assistant Technician:	Sergio Andrada
Statistics:	Lic. Manuel Tozaki
Supervision:	Eng. Emiliano Medina

3. OBJECTIVE

The objective of this proficiency testing program is to determine the composition of low-alloy steels in accordance with the following standard:

Standard
ASTM E1085: 2022

To verify this, low-alloy steel samples were selected.

Participants in this program have not been previously informed about the expected values or value ranges of the samples they receive.

4. PARTICIPANT

Company:	**COLUMBUS STAINLESS**
Laboratory:	**Instrument Laboratory**
Country:	South Africa
Client ID:	F290
Contact person:	Kebuile Moseki Lab Specialist moseki.kebuile@columbus.co.za

5. HOMOGENEITY

Several batches were prepared identically by the staff at South Quality.

Subsequently, a homogeneity study was conducted with an ISO 17025 accredited laboratory.

The control process followed ISO 33405: 2024, clauses 7.4.1.1 / 7.4.1.2. Stratified random sampling was applied, and samples were selected using random number generation software.

The results of this test are presented below:

Size of each batch: **50 units** Tested samples from each batch: **10 units**

DETERMINATION	HOMOGENEITY OF RESULTS IN THE ANALYZED SAMPLES		
	BATCH: LM3884	BATCH: LM3885	BATCH: LM3886
MASS FRACTION	YES	YES	YES

Size of each batch: **50 units** Tested samples from each batch: **10 units**

DETERMINATION	HOMOGENEITY OF RESULTS IN THE ANALYZED SAMPLES		
	BATCH: LM3914	BATCH: LM3915	BATCH: LM3916
MASS FRACTION	YES	NO	NO

Samples for this program are taken from the selected batches identified as **LM3885** and **LM3914**.

For the indicated batches, the values determined in the homogeneity study are utilized as the assigned values.

The analysis of the test data indicated that the selected samples exhibited sufficient homogeneity for the program. Therefore, the results of participants identified as outliers cannot be attributed to sample variability.

6. SAMPLE INFORMATION

The following samples were sent for testing:

Batch:	LM3885
Sample ID:	23
Characteristics:	Low-alloy steel (SAE 4140) - Ø 35 x 20 mm

Batch:	LM3914
Sample ID:	12
Characteristics:	Low-alloy steel (SAE 5160) - 63 x 41 x 12 mm

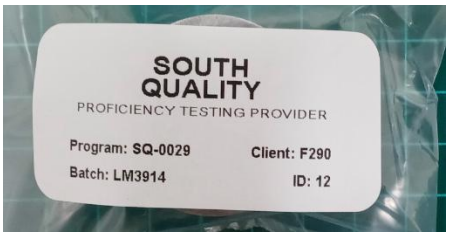
7. IMAGES

SAMPLES









8. ASSIGNED VALUES

BATCH	MASS FRACTION, % (Standard deviation)					
	CALCIUM	CHROMIUM	COBALT	COPPER	MANGANESE	MOLYBDENUM
LM3885	—	0.960 (0.065)	0.014 (0.0020)	0.038 (0.0040)	0.800 (0.070)	0.190 (0.016)
LM3914	—	0.013 (0.0020)	—	0.0105 (0.0020)	0.810 (0.070)	—

BATCH	MASS FRACTION, % (Standard deviation)					
	NICKEL	NIOBIUM	PHOSPHORUS	SILICON	SULFUR	VANADIUM
LM3885	0.075 (0.010)	—	—	0.250 (0.050)	0.018 (0.0060)	—
LM3914	—	—	—	0.235 (0.045)	0.025 (0.0060)	—

9. PARTICIPANT RESULTS (SEE APPENDIX)

CODE	MASS FRACTION, %					
	CALCIUM	CHROMIUM	COBALT	COPPER	MANGANESE	MOLYBDENUM
LM3885-23	No reportable	0.993	0.015	0.035	0.832	0.202
LM3914-12	No reportable	0.0117	Below LOQ	0.0091	0.826	Below LOQ

CODE	MASS FRACTION, %					
	NICKEL	NIOBIUM	PHOSPHORUS	SILICON	SULFUR	VANADIUM
LM3885-23	0.083	Below LOQ	Below LOQ	0.234	0.022	Below LOQ
LM3914-12	Below LOQ	Below LOQ	Below LOQ	0.220	0.029	Below LOQ

10. STATISTICS

The results must be treated as quantitative.

According to B.4.1.3 of ISO 17043 the appropriate technique is to compare participant results with the assigned values. The results can be compared using **z score.**

$$z = \frac{x - X}{\hat{\sigma}}$$

x is the participant's result

X is the assigned value

$\hat{\sigma}$ is the standard deviation

The performance evaluation of each sample is carried out with the following criteria:

$|z| \leq 2.0$ indicates "satisfactory" performance and generates no signal;

$2.0 < |z| < 3.0$ indicates "questionable" performance and generates a warning signal;

$|z| \geq 3.0$ indicates "unsatisfactory" performance and generates an action signal;

11. EVALUATION OF PERFORMANCE

BATCH LM3885

ELEMENT	MASS FRACTION, %		| z score |	PERFORMANCE RESULT
	PARTICIPANT RESULT	ASSIGNED VALUE		
CHROMIUM	0.993	0.960	**0.51**	**SATISFACTORY**
COBALT	0.015	0.014	**0.50**	**SATISFACTORY**
COPPER	0.035	0.038	**0.75**	**SATISFACTORY**
MANGANESE	0.832	0.800	**0.46**	**SATISFACTORY**
MOLYBDENUM	0.202	0.190	**0.75**	**SATISFACTORY**
NICKEL	0.083	0.075	**0.80**	**SATISFACTORY**
SILICON	0.234	0.250	**0.32**	**SATISFACTORY**
SULFUR	0.022	0.018	**0.67**	**SATISFACTORY**

BATCH LM3914

ELEMENT	MASS FRACTION, %		| z score |	PERFORMANCE RESULT
	PARTICIPANT RESULT	ASSIGNED VALUE		
CHROMIUM	0.0117	0.0130	**0.65**	**SATISFACTORY**
COPPER	0.0091	0.0105	**0.70**	**SATISFACTORY**
MANGANESE	0.826	0.810	**0.23**	**SATISFACTORY**
SILICON	0.220	0.235	**0.33**	**SATISFACTORY**
SULFUR	0.029	0.025	**0.67**	**SATISFACTORY**

12. CONCLUSIONS

The overall performance on this **SQ-0029** program from the participant laboratory **COLUMBUS STAINLESS - Instrument Laboratory**, is **SUFFICIENT** based on expected results.

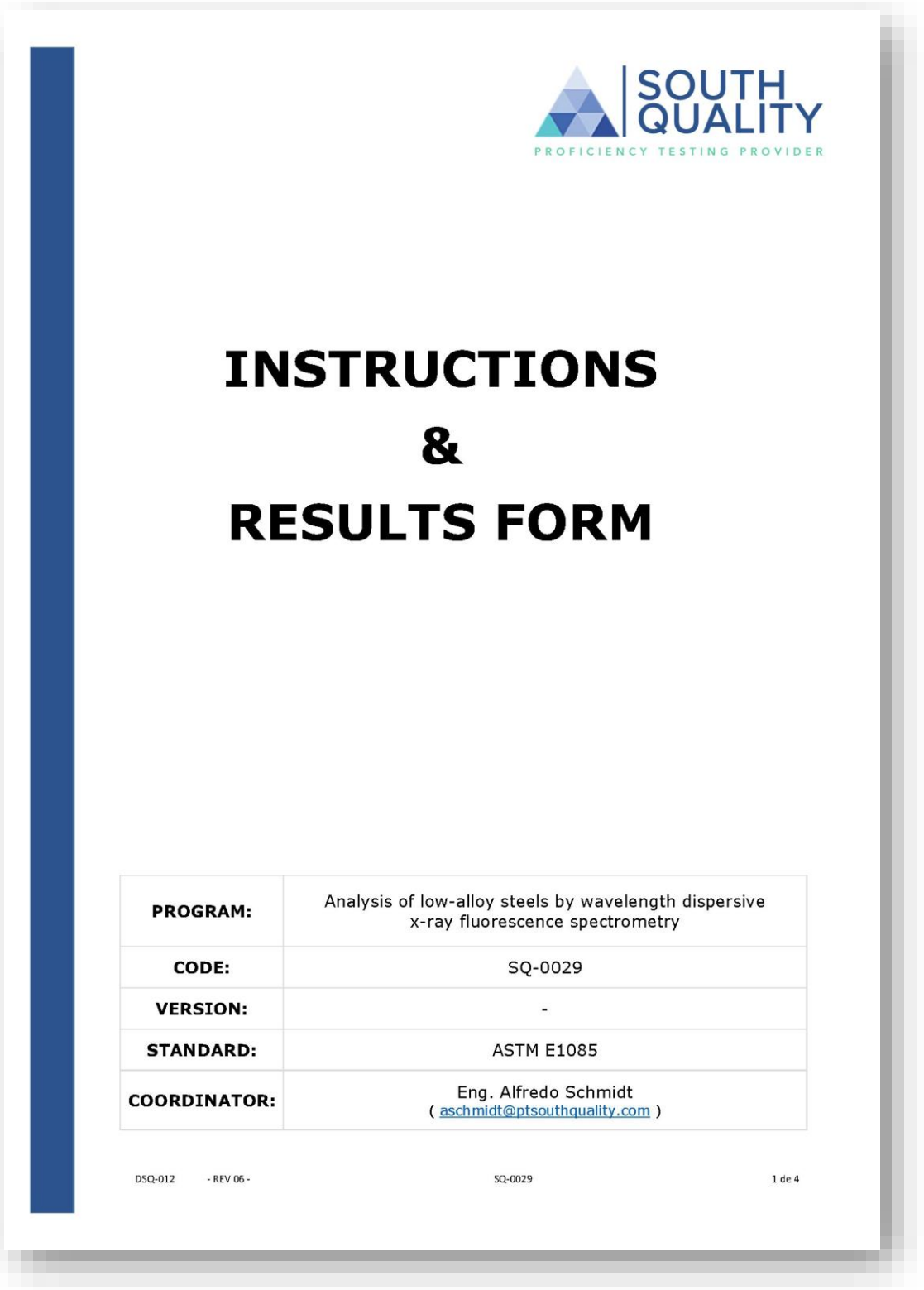
The criteria used for the evaluation of the overall performance are the following:

- **SUFFICIENT** performance: No unsatisfactory/questionable results were obtained.
- **ALMOST SUFFICIENT** performance: No unsatisfactory results were obtained, but one questionable result was found.
- **INSUFFICIENT** performance: An unsatisfactory result or two questionable results were obtained.

APPENDIX

PARTICIPANT RESULTS

(Results form)



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INSTRUCTIONS
&
RESULTS FORM

PROGRAM:	Analysis of low-alloy steels by wavelength dispersive x-ray fluorescence spectrometry
CODE:	SQ-0029
VERSION:	-
STANDARD:	ASTM E1085
COORDINATOR:	Eng. Alfredo Schmidt (aschmidt@ptsouthquality.com)

DSQ-012 - REV 06 - SQ-0029 1 de 4

1 - **General**

This document serves as a guide for managing the results of the **SQ-0029** program.

Results must be typed, not handwritten.

2 - **Standard**

ASTM E1085: 2022

3 - **Tests involved**

TEST
Determination of the composition of low-alloy steels by wavelength-dispersive X-ray fluorescence analysis

4 - **Samples**

CODE	SAMPLE	QUANTITY
LM3885-23	Low-alloy steel - Ø 35 x 20 mm	1
LM3914-12	Low-alloy steel - 63 x 41 x 12 mm	1

5 - **Notes**

a) Being a bilateral program, there is no deadline for submitting results.
b) The tables in this document may be modified by the participant, if desired, to include data or observations.
c) The samples are to be handled as routine lab samples, with all testing, documentation, and reporting adhering to **ASTM E1085**.
d) The surfaces where the tests must be carried out can be either of the two faces.
e) Participants may improve the surface to provide a better testing surface. If this is done, the procedure must be detailed in the 'observations' box.
f) Samples must be retained until the end of the program, which concludes with the submission of the final report.
g) To review the results, test images would be appreciated. Images can be attached at the end of this document or sent by email.
h) Once this document is completed, it must be converted into a PDF file and sent to the program coordinator.

6 - **Test conditions**

Procedure:	According to standard
Final grinding:	-grit

7 - **Test results**

ELEMENT	MASS FRACTION, %	
	LM3885-23	LM3914-12
CALCIUM	No reportable	No reportable
CHROMIUM	0.993	0.0117
COBALT	0.015	Below LOQ
COPPER	0.035	0.0091
MANGANESE	0.832	0.826
MOLYBDENUM	0.202	Below LOQ
NICKEL	0.083	Below LOQ
NIOBIUM	Below LOQ	Below LOQ
PHOSPHORUS	Below LOQ	Below LOQ
SILICON	0.234	0.220
SULFUR	0.022	0.029
VANADIUM	Below LOQ	Below LOQ

OBSERVATIONS

PHOTOGRAPHS

Before analysis



After analysis



----- END OF REPORT -----